T/N 329
Filing Code 6611

Date Issued January 1979

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

TECHNICAL NOTE

U.S. DEPARTMENT OF THE INTERIOR – BUREAU OF LAND MANAGEMENT

HABITAT MANAGEMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES

by
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REPORT NO. 18
BLACK HAWK
(Buteogallus anthracinus)

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TABLE OF CONTENTS

Introduction

The objective of this report is to provide Bureau of Land Management personnel with the latest and most up-to-date information on rare or endangered species occurring on the public domain. This will provide a tool for improved understanding of the interrelationships between the species and its environment and will encourage an end product of enlightened land management which will fully consider the species' welfare in all management decisions.

Species Description

The common (Mexican) black hawk (Buteogallus anthracinus) is a large exotic raptor which attains its maximum abundance south of the United States-Mexico border. Its closest relatives are of the genera Harpyhaliaetus, Heterospizias and Leucopternis (e.g. solitary crowned eagle, savannah hawk and white hawk, respectively) which are found in Mexico, Central and South America. There are three races of Buteogallus anthracinus: the insular B. a. gundlachii of Cuba and Isle of Pines; B. a. subtilis which is confined to the mangrove zone of the Pacific coast and islands from southern Mexico to northwestern Peru; and B. a. anthracinus (the only race breeding in the United States) which ranges from southwestern United States to northwestern Peru on the Pacific, and northwestern Guyana on the Atlantic (Brown and Amadon, 1968).

As its name implies the adult is almost completely black and when viewed at close range the plumage appears to have a glaucous cast or bloom, imparting a slate-black color. Soaring overhead a broad white band 30 to 80 mm wide can be seen in the middle of the tail; a thin terminal band also tips the retrices, but this usually goes unnoticed because of the striking median band. Although seldom confused in flight because of their differing shape and tail pattern (see Figure 1) the black hawk and zone-tailed hawk (Buteo albonotatus) are essentially identical when perched and the tail barring is obscured. Both have all black body and wings, yellow legs and cere and black bill tips. They were confused in the early literature (Bendire, 1892; Bohl and Taylor, 1958). In areas where both species nest in the same habitat, identification is almost impossible until the adult flies from the nest or calls defensively. The zone-tailed hawk utters a continuous Buteo-like scream, in contrast to the black hawk's peculiar staccato noted call. The latter is composed of about seven to eight piercing, multi-pitched notes which

increase abruptly in intensity and then taper off with the last notes uttered more softly (Schnell, Glinski, Snyder and Ohmart, 1975). There is no discernible sexual dimorphism in the black hawk when it is observed in the field. Female wing and tail measurements average 14.4 mm and 15.9 mm, respectively, larger than males, but overlap is considerable. The middle toe and claw of the two sexes differ only by .1 and .4 mm, respectively (Friedman, 1950). The dimorphic index as calculated from wing and tail is only 2.7 (Snyder and Wiley, 1976).

Eggs are grayish-white to greenish-white and are heavily speckled with varying shades and sizes of brown blotches. Zone-tailed hawk eggs are usually unmarked.

The hatchling is covered with yellowish-white down and has reddish-brown dorsal areas on the head, body and wings. At two weeks the second down has emerged which imparts a woolly, more grayish-white appearance; the dorsal areas are still reddish-brown and pin feathers are becoming visible on the primary and secondary tracts. A brownish-black, diagonal, mask-like stripe is present on the side of the head at hatching (Figure 1). It passes through the eye and is about the same width as the maximum diameter of the eye. At three weeks of age it is still faintly visible. Tiny feathers protrude in tracts along the side of the neck and between the shoulders at this age. Primaries appear to be about 10 mm long (viewed through a telescope). At four weeks of age the majority of the chick has changed from light to dark as contour feathers cover the folded wings, back and usually the nape to a line above the posterior margin of the eye. Some scattered feathers begin to emerge on lower portions of the leggings. At five weeks cross barring is complete on leggings, neck is fully feathered and dorsal head feathers have proceeded to a line approximately equal with the anterior margin of the eye. The tail does not touch the nest when the hawklet is standing. At six weeks the dorsal head feathers have progressed to the cere and are not interrupted by down. The tail touches the nest when the bird is standing. At this age the hawklet is ready to fledge and has assumed its immature plumage, however, the wings and tail have not reached their full length (Schnell, et al., 1975).

Immature plumage is dark brown dorsally; the breast and throat region is yellowish-tan, heavily streaked with dark brown wedges and diamond shaped blotches. The iris is dark brown. Legs and cere are yellow to greenish-yellow. The bill tip is black. The tail is alternately banded with five to seven brown bands about 10 to 30 mm wide. Little

Zone-tailed hawk

Black hawk

Figure 1

is known of immature plumage changes. Bent (1937) reasons that the immature plumage is worn for at least one year without much change and states further that some black adult feathers are acquired beginning with the initiation of a December molt. "A complete molt continues through summer and fall and by January the adult plumage is practically complete" (Bent, 1937). Although not confirmed, the description infers that about two and one-half years elapse before the adult plumage is attained.

Distribution

The black hawk has a limited range in the United States (Figure 2); it breeds only in natural or relatively unaltered riparian habitats in the Southwest. About 80 to 90 percent occur in Arizona. (Snyder and Glinski, 1976) and several pairs are known to nest in Texas (Epsy, 1978; Gehlbach, 1978; Runnels, 1978; Webster, 1976). Possible nesters were reported in southwestern Utah (Carter and Wauer, 1965) and a lone juvenile found on 25 August 1965 suggests a successful nesting (Wauer and Russell, 1967) but in 1976 no active nests were located (Snyder, 1978).

A minimum estimate of four black hawks (probably *B. a. gundlachii*) were reported in Florida between 1972 and 1975. These wanderers could have been searching for suitable nesting habitat but this is speculative (Abramson, 1976). Even more mysterious is the September record of a black hawk struck by a truck near Bemidji, Minnesota (Kimball, 1977). Probably its presence here was not caused by natural agents.

Little is known about migration movements. It is unknown whether the United States' birds make extended flights to South America, short hops to northern Mexico or stop off somewhere in between. Probably the majority have left the United States by mid-October. On rare occasions they may be seen in southern Arizona in the winter (Phillips, Marshall and Monson, 1964) and individuals are sometimes seen in the lower Rio Grande of Texas (Gehlbach, 1978).

Status and Population Trend

The black hawk is not listed on the official United States list of endangered species. The Arizona and New Mexico Game and Fish Departments list it with species or subspecies whose status may be in jeopardy in

Figure 2. DISTRIBUTION OF BLACK HAWKS IN THE UNITED STATES

the foreseeable future (Threatened Wildlife of Arizona - Mimeo; New Mexico State Game Commission's Regulation No. 563, respectively). Destruction or alteration of suitable habitat throughout its range gives cause for serious concern about the future of the species in the United States.

After censusing suitable habitat Snyder and Glinski (1976) estimated that there were about 200 pairs nesting in Arizona and New Mexico. In Texas there are four or five nest sites, and possibly one in Utah when environmental conditions are optimum.

Although black hawks will nest every year (environmental conditions permitting) the maximum clutch size of two eggs and the high incidence of one egg clutches in the United States gives evidence for a low reproductive potential; on the Aravaipa River the number of fledglings per active territory was .55 in 1976 and 1.09 in 1977 (Schnell, 1978). Never-the-less, it is felt that the United States population would be self sustaining if riparian habitat were not decreasing in the Southwest (Snyder, 1978).

Life History

Little information has been published on life history and the following discussion will draw on our research observations, especially at the Aravaipa River study area (Schnell, et al., 1975), unless otherwise cited.

Black hawks appear to be chunky, rather sluggish birds when seen flying about the nest area. However, they are capable of surprisingly rapid maneuvers when defending the nest and performing aerial courtship flights.

Sexes are indistinguishable morphologically. One must rely on peculiar characteristics such as missing or misplaced feathers to recognize individuals and then determine by behavior which is male and female. The most reliable method of sexing black hawks is to (1) observe which bird is incubating at dawn since the female always covers the eggs at night, and (2) observe copulation.

Courtship begins immediately after the adults arrive on the nesting ground. In eastern Arizona (Aravaipa River) this may be as early as March 11, but in the Davis Mountains of Texas, first arrivals appear about April 1 (Espy, 1978). The most complete courtship behavior patterns were observed when both members were soaring together;

however, single courtship flights were performed by a male who arrived about one week before his mate. During courtship, one member of the pair would take the more active role in flying downward to the soaring mate with slow accentuated wing beats. The descending bird with legs dangling would then swoop upward upon arriving at the position of the mate two or three times in succession. Adults will also dangle the legs when diving and defending the nest against human intruders. Another common courtship flight pattern was a stalling maneuver usually performed close to the mate. Vocalizations often accompanied these maneuvers. Courtship flights occurred at varying altitudes; the maximum was estimated to be more than a mile above the ground level, and one bird remained .75 to 1.0 mile high, intermittently performing courtship maneuvers and territorial border chases with an adjacent pair member for one hour and three minutes. Courtship flight behavior is similar to territorial border aggression except that evasive flight maneuvers accompany the latter.

Nest site selection may begin as early as 5 days after arriving on the breeding ground; at this time pair members (probably most often the male) may simply visit old nest sites and remain perched near the nest. Twelve pairs studied on the Aravaipa River selected cottonwood trees exclusively during three nesting seasons with the exception of one nest site in a sycamore. Other species of trees selected in Arizona and New Mexico were alders, velvet ash, Ponderosa pine and Douglas fir (Glinski, 1978). On the Aravaipa River average nest height was about 55 feet (maximum equals 82 feet) and they were located an average of 80 feet from running water. Brown and Amadon (1968) report a nest height range of 15 to 100 feet for the species. Nests were found as low as 1420 feet elevation (Glinski, 1978) and as high as 6000 feet elevation (Espy, 1978; Runnels, 1978; Glinski, 1978).

During the early nest building stage the male collects and carries most of the nest material to the site while the female incorporates it into the nest matrix. Willow, cottonwood, juniper and walnut twigs are known to be used. Twigs may be picked up from a ledge or hillside within 200 feet of the nest or broken loose from trees near the nest; twigs average about ¼ inch in diameter. As the nest nears completion a greater number of leafed twigs are delivered. On March 26, 1976 only leafless twigs were used in construction at one nest, but 10 days later leafed cottonwood branchlets appeared on the nest floor, and were delivered to the nest. This is partly caused by the absence of emergent vegetation when nest building begins, but evidence also indicated that the male selects leafless twigs initially and then switches to leafed twigs. For example, on May 3 (during incubation)

the male persisted in delivering leafless sticks even after the surrounding cottonwood vegetation was fully emerged and the female was bringing in only leafed twigs. Then, after May 10, the male brought only leafed twigs. The female was never observed to deliver a leafless twig to the nest; she is primarily responsible for the build up of leafed twigs, which eventually become compressed in the cup forming a leaf lining. The parents continue to lay leafed twigs on the nest until the young fledge; one function of this behavior is to raise the nest floor above the damp, decaying, humus-like nest material left from previous seasons, and the accompanying invertebrate populations.

Night roosting positions of the female become progressively closer to the nest as construction is completed and she may stand on the nest for long periods prior to egg laying.

Copulations increased from zero to four per day as laying time approached on one territory, but ceased completely when a branch fell on the nest. Observed copulations occured 50 to 300 feet from the nest on an exposed branch or prominent rock. The male often swooped toward the female, landing directly on her back. At other times he perched beside her, then mounted. His wings were flapped and extended laterally to maintain balance. The female's tail is turned sidewise exposing the white median tail band and her body is positioned halfway between normal perching posture and the horizontal. A distinctive call lasting about ten seconds is given during copulation.

Eggs are probably laid at two or three day intervals. Of seven known clutches four had two eggs and three had one egg. Three egg clutches were not found although they have been reported elsewhere (Brown and Amadon, 1968).

Incubation was determined to be 39 days ($\pm$ one day). The male shares the incubation duties beginning with the first egg laid. Although the female always covers the eggs at night the male at his peak (mid-incubation period) contributed 54 percent of the diurnal incubation time. However, the male's incubation time was controlled by the female; for example, the incubating female did not always relinquish her position to the male when he visited the nest, but the incubating male always yielded to the returning female.

After an egg is laid its chances for hatching and eventual fledging are good. Of 13 known eggs laid, nine produced fledglings; one was infertile, one chick (about 12 days old was probably killed by its

nest mate and two chicks (about 27 days old) disappeared prematurely from the nest. The eggs of 75 percent of the Aravaipa population hatched from May 18 to May 30; the latest nester's single egg hatched July 28, 1977. In one nest the first egg hatched at 4:53 p.m. and the second egg hatched at 12:55 p.m., 44 hours and 2 minutes later. When pipping begins the female prevents the male from incubating and the male henceforth assumes the role of provider; the female attends the young, and portions out the prey items delivered by the male to the nestlings. The female is rarely away from the nest during the early nestling development period; when she does leave the male often attempts to feed the young. If a prey item is too large to be consumed at one feeding the female caches it. On one occasion a fish was simply cached on a hillside beside a tussock of grass about 75 feet from the nest. As the young developed the female spent progressively less time incubating and attending the nest. In one instance when the young were three weeks of age she left the nest for 12 minutes and returned with a fish. When they were five weeks of age she no longer returned to the nest at night.

The developing young were fed progressively larger portions of prey and at 22 days of age, one chick swallowed a five-inch lizard whole. At this age the hawklet had not acquired the facility for walking in a standing position. At 29 days, it stood for 9 minutes and was observed to display reflexive striking and grasping actions with its talons; also at this age it attempted to tear flesh from a partially eaten fish left in the nest, and the hawklet was observed to flap its wings for the first time. At 36 days, it stood for more than one hour and 43 days it stood continually for 3 hours and 40 minutes.

Fledging age varies from about 43 to 50 days of age. Younger fledglings become secretive and remain fairly stationary after leaving the nest probably because of their reduced flying ability; the parents, in turn, seek them out and bring food to their position. Older fledglings may leave and return to the nest periodically; because of their increased ability to fly; they in turn, are able to fly to the parents to obtain food. The parents may call agressively when human intruders are in the vicinity of the fledged young. The fledglings probably become self sufficient about 1.5 to 2 months after leaving the nest.

Thermoregulation for the black-bodied adults apparently never became a serious problem during the nesting season despite temperatures of 103° to 105°F in direct sunlight. Certainly a black hawk moving freely under the canopy of the riparian vegetation would never encounter

extreme heat stress. The most critical situation occurred on the nest when an individual could not avoid direct sunlight and continued to protect the eggs or young from excessive heat. The first visible thermoregulation employed was intermittent panting; also, the incubating or brooding parent allowed the wings to move laterally and hang loosely while contacting the nest floor. Presumably, this reduced the insulative effect and allowed freer air movement close to the body. An extremely heat stressed adult could always achieve cooling by standing up and fully extending the wings laterally; panting ceased within minutes after assuming this position. When standing, the adult would interpose its body between the sun and the eggs or young, thereby producing a shielding effect. The spread wings also increased the shielding surface, thus producing a larger shadow across the nest. The female, especially, persisted in this shielding behavior; when the sun went behind a cloud or canyon wall the female "relaxed" noticeably and shielding activities were discontinued.

Vocalizations are particularly difficult to describe and assess. The most raptor-like sound functions to signal hunger in the young hawklet; a two day old chick was observed to emit this sound. It was often so faint that the beak was seen to open and close without emitting audible sounds (from 70 feet away); on other occasions it was quite loud and could be easily heard at a distance of 250 feet. It is a clear, high pitched note emitted rapidly (17 calls per five seconds) or more slowly (eight calls per five seconds). A similar call is occasionally given by the adults and it may also serve to indicate hunger or elicit a food transfer. Another distinctive call was given during copulation. It is a monotone sounding series of 20 to 30 rapid notes lasting about ten seconds. The most common call lasting about three to four seconds is a series of about seven or eight piercing, multi-pitched notes which usually increase abruptly in intensity and then progressively decrease. The function of this call is not clearly understood. It is most commonly uttered by adults when defending the nest area from human intruders or large soaring birds; it is also used during courtship maneuvers. The male often utters this call when approaching or leaving the nest with or without prey. It is not known whether subtle differences in intensity and/or duration account for its varied functions.

The food habits vary according to the physical geography of existing nesting habitat (Glinski and Ohmart, 1977). For example, the diet (99 prey items) for a nesting pair located in a broad riparian forest of a wide alluvial valley floor was (in percent): reptiles (47), birds (20), fish (14) arthropods (10), mammals (5) and unidentified (4); whereas the diet (90 prey items) of a nesting pair located in scattered clumps

of riparian forest of narrow, rocky canyons was (in percent): fish (54), frogs (20), reptiles (10), mammals (7), birds (6), and arthropods (3). Diets are also influenced by annual changes in prey abundance (Schnell, Barber and Schnell, 1977). For example, when the Aravaipa frog population was low (1976) the major diet items (in percent) were: fish (54) and frogs (20); however, when the frog population was high (1977) the major diet items (in percent) were: frogs (42) and fish (29.5). In summary, it can be stated that black hawks will prey on the most vulnerable and available living form that coexists in their nesting habitat. The literature is replete with the wide variety of prey foods. For example, crabs are commonly taken in the Honduras (Deighnan, 1936; Thomas, 1908), Cuba (Barbour, 1943), and Florida (Abramson, 1976); crayfish and a small mammal were reported from Chiapas, Mexico (Edwards and Lea, 1955); in southwestern Mexico small quadrupeds, young birds, reptiles, crustaceans, and insects were found in stomachs examined and small fish were also observed eaten (Lawrence, 1876); in Chihuahua, Mexico a large centipede, an adult neuropteran insect, a lizard and two small fish were found in one crop (Stager, 1954); of six stomachs examined in the United States, three had frogs, two had fish and one had a snake (Fisher, 1893); in Arizona Fowler (1903) observed a green-tailed towhee being captured and eaten and Mearns (1886) saw a fish being eaten. A preliminary list of prey items recorded in Arizona and New Mexico to date (Schnell, et al., 1975) includes:

Giant Desert Centipede	(*Scolopendra heros*)
Green Hornworm	(Sphingidae)
Sonora Sucker	(*Catostomus insignis*)
Gila Sucker	(*Pantosteus clarki*)
Leopard Frog and Tadpole	(*Rana pipiens*)
Tree Lizard	(*Urosaurus ornatus*)
Collared Lizard	(*Crotaphytus collaris*)
Clark's Spiny Lizard	(*Sceloporus clarki*)
Sonoran Whipsnake	(*Masticophis bilineatus*)
Garter Snake	(*Thamnophis sp.*)
Cliff Chipmunk	(*Eutamias dorsalis*)
Rock Squirrel	(*Spermophilus variegatus*)
Mouse	(*Peromyscus sp.*)
White-throated Woodrat	(*Neotoma albigula*)
Gambel's Quail	(*Lophortyx gambelii*)
Unidentified	At least two species of nestling birds.

Black hawks are known to feed on carrion. Abramson (1976) reported an immature (probably B. a. gundlachii) feeding on a dead muscovy duck in Florida. Carter and Wauer (1965) noted a black hawk eating a dead mammal on a highway in Utah; Brown and Amadon (1968)state that dead fish stranded on beaches are often eaten. However, during three years of observation in Arizona and New Mexico we did not see black hawks feed on carrion (Schnell, et al., 1975). The retrieval of cached food items is evidence that black hawks will occasionally eat dead and dried flesh when confronted with a food shortage, but this is unusual. The Florida observation involved an immature bird which could have lacked hunting skill, but both it and the Utah observations could involve birds facing a food shortage while wandering, searching for and/or pioneering new suitable habitat.

The hunting behavior of the black hawk is primarily of the "perch-hunting" type. Perches vary from boulders and rocks in rivers at water level to branches 50 feet high. High perches are often used initially to discern areas of the habitat where prey is present; adults often watch attentively in a passive way for long periods of time. An individual intending to catch prey in or along the river will attempt to approach as close as possible; rarely is a strike made from a 50-foot perch. One female was observed in one hour to capture and eat four small fish stranded by receding irrigation water on a pasture below her nest. She accomplished this by two attack methods: (1) a direct strike was performed from perches 15 to 20 feet high into shallow pools and rivulets, and (2) an indirect strike was performed when she landed on the ground beside a pool or in the water, and then attacked the prey. The latter involved springing up and landing on the prey or dashing through the water and with each step stabbing the foot forward in an attempt to contact a swimming fish. Both techniques were successful. She rarely made more than one attack while standing on the ground; it was necessary to be above the prey to see it then swoop close before capture. Often a strike at aquatic prey would only result in fistfuls of algae and other vegetative debris; when this occurred the grasp was slowly released as the hawk watched intently for movement. In addition to the passive type hunting technique, some prey must undoubtedly be captured opportunistically, that is, through accidental encounters. In fact, the male was observed actively coursing through the territory on two occasions apparently attempting to increase the incidence of accidental encounters with prey species. In one instance the hunter flew rapidly from perch to perch at mid canopy level covering a circular distance of about 500 feet; on another occasion he flew from rock to rock up the river and then returned along the same route, covering a distance of probably ¼-mile.

On June 1, 1977 a nesting pair of black hawks with two young were kept under continual surveillance and the location of every prey item captured and subsequently brought to the nest was determined (Schnell, Barber and Schnell, 1975). The male never traveled more than ¼-mile upstream or downstream from the nest when hunting the river, spending the majority of his time searching for prey here; two fish were captured here in a stretch of shallow rapids characterized by scattered boulders. He delivered them to the nest 15 and 24 minutes later, respectively, after the heads were eaten (sometimes the fins are also partially plucked off large fish which are brought to the nest). A freshly-killed collared lizard was captured when the male disappeared for 20 minutes up a side canyon; and a fresh Sonoran whipsnake was brought to the nest eight minutes after he disappeared over a 250 foot canyon wall on the north side of the Aravaipa River. Both of these prey items were probably captured when encountered accidently. About two hours after the last prey item was delivered (1435 hours), the male became involved in a territorial border dispute with the down-stream nesters about ½-mile away. When the young subsequently became hungry the female retrieved the snake she had cached earlier.

Habitat Requirements

In the southwestern United States the black hawk is an obligate riparian nester dependent on mature, relatively undisturbed habitat with a permanent, rapidly flowing stream for survival. Only about one percent of the nest sites are associated with intermittent water courses and these have some water seepage-filled impoundments near the nest site which harbor aquatic prey species (Glinski, 1978; Runnels, 1978; Snyder, 1978). It is undoubtedly the high prey base of these riparian habitats (Carothers and Johnson, 1975) which is responsible for nesting success. Tall trees (75 to 100 feet) must be present along the water course for nesting. Groves of trees are preferred over single trees, probably because the increased vegetative density around the nest site provides escape cover and an element of needed seclusion and protection from human intruders and predators. Some individual nest sites may provide more "hiding protection" than others; for example, a nest located extremely high (above 80 feet) may exceed flushing distance levels allowing nesting birds to remain "unconcerned" when humans pass underneath; likewise nests that are positioned in supporting crotches with extremely thick branches prevent direct line-of-sight views between nest occupants and human intruders. In summary, it can be stated that the most optimum habitat is composed of a flowing water course associated with a well-developed, mature riparian vegetation which has a wide choice of nesting

sites. This is especially important where a high level of human activities and disturbances is present.

Streams of low to moderate gradient and less than one foot deep with scattered boulders are ideal fishing habitats; the presence of numerous low or fallen branches over streams improve prey vulnerability for the hunting black hawks. Flash floods may also be a necessary component of the nesting environment functioning to "rejuvenate" the stream bottom which may become clogged with algae, and choked with rank growths of water cress (Rorippa Nasturtium- aquaticum).

Limiting Factors

The extent of pesticide contamination in the United States is virtually unknown. One infertile egg from the Aravaipa River population in 1977 contained 81 parts per million DDE (Schnell, 1978); the amount of egg shell thinning has not yet been determined, and the origin of this contamination is unknown. However, judging from nesting success data there appear to be no adverse effects being produced as yet.

Human disturbance (excluding habitat destruction) is a factor which is not widely depressing black hawk populations at present but undoubtedly will do so in the future as recreational pressure increases. Peak recreational use of riparian habitats often coincides with the most critical stages of the nesting cycle, that is, nest site selection, nest construction and egg laying. Likewise, nest site locations chosen by black hawks often prove to be the most attractive gathering and camping areas for recreationists (Schnell, 1977; Snyder, 1977). This is even a problem where visitor numbers are limited by permits (BLM Aravaipa Canyon Primitive Area). In riparian habitats where visitor access is uncontrolled, recreational vehicles, campers and hikers have serious potential for causing nesting failures and abandonment (Glinski, 1978; Schnell, 1977; Snyder, 1978). Black hawks also provide inviting rifle targets while on the nest or when flying sluggishly around the nest area (Snyder, 1976).

Direct evidence of predation at nests is lacking, but undoubtedly great horned owls are sometimes implicated (Snyder, 1978; Webster, 1976).

The greatest threat to the black hawks' survival in the United States is elimination and alteration of riparian habitat through phreatophyte control, channelization, damming, clearing for agriculture, irrigation,

and domestic livestock grazing. Habitat destruction may be immediate or long term. Vegetation removal and other physical changes are obvious, but slow acting deleterious processes are just as lethal. For example, the eventual take-over of river bottoms by the introduced salt cedar (Tamarix chinensis) prevents regrowth of native riparian species; irrigation practices which cause lowering of the water table or temporary drying of stretches of river bed disrupts aquatic food chains, and results in a lowered black hawk prey base. "But the most insidious threat to the riparian habitat type today is domestic livestock grazing. Many riparian areas appear to be in good health; on closer examination, we find that while the mature vegetation approaches senescence, grazing pressures have prevented the establishment of seedlings. We are very concerned that when many of these mature stands of trees die of natural causes, there will be no young trees to take their place. Heavy grazing pressures can and do produce even-aged, non-reproducing vegetation communities. Our concern for this habitat's survival can only mount until this situation is remedied." (quoted from Carothers, 1977).

Recommended Species and Habitat Management Techniques

When possible, populations subjected to heavy disturbance pressures, that is, those not nesting in remote regions, should be protected from certain types of chronic human activities, or the effects of these activities should be mitigated. Of course, this is only possible where natural areas of riparian habitat are administered by federal agencies or private organizations. To assure a continually viable black hawk population under these conditions it is essential to limit access to hikers and horseback riders only (no vehicles in or along river), and restrict the number and length of stay of visitors. The exact visitor quotas, length of stay, etc. are still being worked out at the Aravaipa Canyon Primitive Area (Safford, Arizona District - BLM). It may also be important to temporarily close an area which is heavily used by recreationists during the egg laying period (April 10 to April 20) to encourage a successful initiation of the nesting cycle. In addition it may be necessary to mitigate the effects of human activity at some established nest sites by re-routing hiking trails away from nest trees and preventing direct line of sight views to nests. Of course, definite measures should be taken to prevent backpackers from setting up campsites directly under nest trees, as this would undoubtedly cause nest abandonment during any stage of the nesting cycle.

Major habitat management techniques must be directed towards rejuvenating and perpetuating the mature riparian habitat type. If mature canopy trees are all of even age and no recruitment of young trees (especially cottonwood) is occurring, it may be necessary to augment natural regeneration processes by excluding domestic livestock. This can be done by (1) planting individual saplings in protective exclosures or (2) fencing off large acreages of river bottom until sapling height has grown beyond the livestock browse line.

Another habitat management approach at nest sites sustaining abnormally high human disturbance or where nest failures are consistent, would be to increase prey availability. This could be achieved by placing additional hunting perches over streams and to install low cross dams near nest sites. Impoundments serve to concentrate fish and frogs and thus provide a supplementary food supply for nesting black hawks. However, dams should never stop water flow in the natural river bed, which occurs with most irrigation procedures.

Protective Measures Instituted or Recommended

A. Legal or Regulatory

No legal measures exist to specifically protect the black hawk, other than regulations protecting all other raptors. Perhaps future regulatory measures taken to protect endangered fish populations will result in the perpetuation of some hawk riparian habitats.

1. Regulations administered by the United States Environmental Protection Agency limiting the use of DDT and other persistent pesticides should reduce pesticide burdens in prey. No organochlorine pesticides should be used in riparian waters or in any watersheds upstream from nesting areas. Before implementing any chemical control procedures, the effects on black hawk reproductive success and prey food supplies should be fully ascertained.

2. The black hawk is included in the treaty signed by the United States and Mexico in 1972, bringing birds of prey under international protection.

B. Habitat Protection

Of the five major nesting areas in the United States, the BLM's Aravaipa Canyon Primitive Area is the only one fully protected. Here management policies are designed to rejuvenate and perpetuate riparian habitat. However, since this area contains only about two to three percent of the total United States' black hawk population, and since 66 percent of the nest sites in the United States are on private and Indian lands (Snyder, 1976) where continued security is questionable, it is recommended that additional black hawk management areas be established in the United States.

Ongoing Research Projects

1. Richard Glinski working with Dr. R. Ohmart of Arizona State University under a contract with the Bureau of Reclamation, is conducting continuing research on black hawks and other raptors in areas of potential impact from the Central Arizona Project.

2. Steve Runnels, of the Dallas Museum of Natural History is finishing a six year study on the black hawks of Texas.

3. Jay H. Schnell is now in the fourth year (1978) of a study on the Aravaipa River black hawk population in Arizona.

4. Helen Snyder is now in the third year (1978) of a study on the status and distribution of the black hawk in the United States for the World Wildlife Fund and the International Council for Bird Preservation.

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   Dallas Museum of Natural History
   P.O. Box 26193
   Dallas, Texas 75226

3. Jay H. Schnell
   George Whittell Wildlife Preserve
   Box 54; Klondyke Rural Station
   Willcox, Arizona 85643

4. Helen Snyder
   Box 135
   Portal, Arizona 85632

Governmental and Private Organizations Concerned with This Species' Welfare

1. National Audubon Society
   950 Third Ave.
   New York, New York 10022

   One major objective of the National Audubon Society is to advance public understanding of our wildlife, its habitat and all natural resources, and relationship of wise use and intelligent treatment of human progress.

National Audubon has a series of leaflets and charts on birds of prey and has concentrated its efforts for raptors in the area of education and protective legislation. The Audubon Society has contributed funds for black hawk research.

2. Southwest Hawkwatch
P.O. Box 95A - 1
Sasabe Star Route
Tucson, Arizona

A non-profit organization with membership open to all persons interested in raptors. Its objectives are to give support and guidance to biological study, to exchange ideas and information, and to focus information into conservation and education channels for the protection and preservation of raptor populations. In addition to an active southwestern program in cooperation with the Hawk Migration Association of North America, Southwest Hawkwatch maintains continuing status records of black hawks and all other southwestern raptors.

3. Chihuahuan Desert Research Institute
P.O. Box 1334
Alpine, Texas 78930

A non-profit organization devoted to biological research, education, and preservation of the Chihuahuan Desert ecosystem. An active group of field biologists are conducting raptor research and other basic studies in the United States and Mexico. This organization also serves as a clearing house for information concerning raptors in their region of the Southwest and Mexico. Director of research: Dr. Granger Hunt.

Summary

The black hawk (Buteogallus anthracinus) is an exotic, neo-tropical raptor which occurs in the United States only in the Southwest. It has been confused with the zone-tailed hawk which occasionally nests in similar habitat, has a similar (though narrower) white band in the tail, similar black body, bill tip and wings, yellow legs and cere. In flight silhouette the black hawk is more chunky with a shorter tail; its voice is probably the most unique of all United States raptors being composed of seven to eight piercing staccato notes which have a multi-pitched quality. The zone-tailed utters a continuous Buteo-like call.

Sexes cannot be distinguished morphologically, so the most reliable methods of sexing black hawks are (1) observe which bird is incubating at dawn, since the female always covers the eggs at night, and (2) observe copulation. Courtship begins as soon as the pairs arrive on the nesting territories and takes the form of aerial dives, swoops, stalls, accentuated wing beats and vocalizations. These behaviors are often accompanied with legs dangling and may be performed one mile or more above ground level. Territorial aggression is similar to courtship except for evasive flight maneuvers. The most common nesting sites are in cottonwoods but sycamore, alder, ash, Ponderosa pine and Douglas fir are also selected. Nest elevations ranged from 1420 feet to 6000 feet. Nests are usually constructed initially from leafless branchelets and then leafed twigs are added. The latter become matted, forming a leaf lining. The male initially brings mostly leafless twigs to the nest; the female always brings leafed twigs. Copulations increase as egg laying time approaches. A distinctive call lasting about 10 seconds is given during copulation. Eggs are probably laid at two or three day intervals and about 57 percent of the clutches are two eggs and 43 percent contain one egg. Incubation was determined to be about 39 days. The eggs of 75 percent of the Aravaipa River population hatched between May 18 and May 30; the latest nester's single egg hatched July 28, 1977, almost two months later.

The hatchling is yellowish-white with reddish-brown dorsal areas on head, body and wings and it has a brownish-black, diagonal, mask-like stripe passing through the eye on each side of the head. The fledging stage is reached when the tail of the standing hawklet is long enough to contact the nest.

The immature plumage is dark brown dorsally; the breast and throat region is yellowish-tan, heavily streaked with dark brown wedge and diamond-shaped blotches. The iris is dark brown, legs yellowish to greenish-yellow and the bill is tipped with black. This plumage is probably retained for about 2.5 years before the adult plumage is acquired.

After hatching, the male becomes the primary provider for the family and the female defends the nest area, feeds and attends the young. As the young develop, they are fed progressively larger portions of prey, and at about four weeks may begin to disarticulate whole prey items left in the nest. After fledging, they continue to be fed and protected by the parents until they are self sufficient (1.5 to 2 months).

Black hawks will prey on the most vulnerable and available living forms that co-exist in their nesting habitat. Aquatic vertebrates are often the major prey items, but reptiles, mammals, nestling birds and arthropods are also taken. Carrion is sometimes eaten, as are cached prey items which become dry and unpalatable, but this is probably only during times of food shortage. Black hawks hunt primarily from perches which vary from rocks at water level to branches 50 feet high; strikes are usually made at close range and rarely from a high perch. In addition to passive perch hunting, prey is also undoubtedly captured opportunistically through accidental encounters. Mid-canopy and water course forays probably increase the incidence of accidental encounters with prey. In one pair studied, hunting was not more than ¼-mile upstream or downstream from the nest and the male often returned to the same stretch where fishing was previously successful; one such area was a stretch of shallow rapids characterized by scattered boulders. Fish are often brought to the nest headless and with fins partly plucked off. The female may cache and retrieve caches depending on the food energy needs of the young.

The range of the black hawk in the United States is limited to Utah, Arizona, New Mexico, and Texas; 80 to 90 percent of the nesting sites are located in Arizona. The migration movements of black hawks are unknown, but the majority leave the United States by mid-October. On rare occasions they are seen in southern Arizona and along the Rio Grande River Valley of Texas in winter.

Black hawks are obligate riparian nesters and require a mature, relatively undisturbed riparian habitat with trees 75 to 100 feet tall and with a permanent, rapidly flowing stream. It is undoubtedly the high prey base of these riparian habitats which is responsible for nesting success. Optimum streams are of low to moderate gradient and less than one foot deep. The greatest threat to black hawk survival in the United States is elimination and alteration of riparian habitat through phreatophyte control, channelization, damming, irrigation, clearing for agriculture and domestic livestock grazing.

The black hawk is not listed on the official United States endangered species list but it is considered "threatened" by the Arizona and New Mexico State Fish and Game Departments. Destruction and alteration of suitable habitat throughout its range gives cause for serious concern about the future of the species in the United States. It is estimated that about 200 pairs breed in the United States. Although the reproductive potential is low (clutch size equals one to two eggs) it is felt that the United States population would be self sustaining if riparian habitat were not decreasing.

Recommended species and habitat management techniques for fully protected habitats (for example, the BLM Aravaipa Canyon Primitive Area) include exclusion of vehicles, regulation of recreation visitor numbers and length of stay, closure of nesting grounds during the egg laying period, re-routing of hiking trails, prevention of camping below nest trees and increasing prey availability in territories with consistent nesting failures. The single most important measure that can be taken to assure continuation of present viable riparian habitat (especially cottonwoods) is to rejuvenate regenerative processes. In most cases this would involve removing or fencing out livestock. Since only two to three percent of the United States' birds nest in habitat that is fully protected and 66 percent of the nesting sites in the United States are on private or Indian lands where continued security is questionable it is recommended that additional black hawk management areas be established in the United States.

LITERATURE CITED

Abramson, I. J. 1967. The Black Hawk (Buteogallus anthracinus) in South Florida. Amer. Birds 30:661-662.

Barbour, T. 1943. Cuban Ornithology. Memoirs Nuttal Ornithological Club, No. 9, 144pp.

Bent, A. C. 1937. Life Histories of North American Birds of Prey. U.S. National Mus. Bull. 167, 409pp.

Bohl, W. H. and E. Taylor. 1958. Correction in Identification of the Zone-Tailed Hawk as a Mexican Black Hawk. Condor 60:139.

Brown, L. and D. Amadon. Eagles, Hawks and Falcons of the World. McGraw-Hill, New York, 2 vol., 945pp.

Carothers, S. W. 1977. Importance, Preservation and Management of Riparian Habitats: An Overview. In: Importance, Preservation and Management of Riparian Habitat: A Symposium, pp. 2-4. U.S. D.A. Forest General Technical Report RM-43, 217pp.

_____ and R. R. Johnson. 1975. The Effects of Stream Channel Modification on Birds in the Southwestern United States. pp. 60-76. In Pro. of Symp. on Stream Channel Modification, U.S.D.I. Fish and Wildl. Serv., Off. Biol. Serv. Wash., D.C.

Carter, D. L. and R. H. Wauer. 1965. Black Hawk Nesting in Utah. Condor 67:82-83.

Deighnan, H. G. 1936. Notes on a Small Collection of Birds from the Republic of Honduras. AUK. 53:168:193.

Edwards, E. P. and R. B. Lea. 1955. Birds of Monserate, Chiapas. Condor 57:31-54.

Espy, Pansy. 1978. Personal Communication: March 6, 1978.

Fisher, A. K. 1893. The Hawks and Owls of the United States in Their Relation to Agriculture. U.S. Dept. Agric., Orn. and Mamm., Bull. 3.

Fowler, F. H. 1903. Stray Notes from Southern Arizona. Condor:68-71.

Friedman, H. 1950. Birds of North and Middle America, Part 11, Falconiformes, 798pp. Smithsonian Inst. Washington, D.C.; U.S. Govt. Printing Office, Wash.

Gehlbach, F. 1978. Letter dated March 9, 1978.

Glinski, R. 1978. Personal communication. March 7, 1978.

_____, and R. D. Ohmart. 1977. The population Habitat and Diet of the Black Hawk in Arizona and New Mexico. Paper presented at the 19th annual meeting of the Arizona Academy of Science.

Kimball, J. 1977. Sharp Eyes Find Mexican Black Hawk. Minneapolis Tribune. Sunday Jan. 9, 1977.

Lawrence, G. N. 1876. Birds of Southwestern Mexico Collected by Francis E. Sumichrast for the U.S. Nat. Mus., Bull. No. 4.

Mearns, E. A. 1886. Some Birds of Arizona. Auk:60-73.

Phillips, A., J. Marshall and G. Monson. 1964. The Birds of Arizona, Univ. Ariz. Press 220pp.

Runnels, S. 1978. Personal communication, Feb. 22, 1978. Six year report in preparation.

Schnell, J. H. 1977. Behavior and Ecology of the Black Hawk (Buteogallus anthracinus) in Aravaipa Canyon (Graham/Pinal Counties) Arizona. Second progress report to the BLM. Sept. 1977, 35pp.

_____. 1978. Some Effects of Human Disturbance on Nesting Black Hawks and Possible Management Techniques. Paper presented Feb. 3, 1978 at section meetings of the Wildlife Society, Douglas, Ariz.

_____. J. C. Barber and V. M. Schnell. 1975. Prey Abundance and Nesting Success of Black Hawks in Aravaipa Canyon. In preparation.

_____. R. Glinski, H. Snyder, and R. D. Ohmart. 1975. Natural History, Behavior and Ecology of Black Hawks in Arizona and New Mexico. In preparation.

Snyder, H. 1976. Preliminary Report on the Status, Distribution and Ecological Requirements of the Black Hawk in the United States of America. Interim report to the World Wildlife Fund and the International Council for Bird Protection.

_____. 1977. Report on Black Hawk Survey Given at Raptor Research Foundation Annual Meeting, 1977, Tempe, Arizona.

_____. 1978. Personal communication. March 21, 1978.

_____, and R. Glinski. 1976. Status and Distribution of Black Hawks in Arizona and New Mexico. Paper in preparation.

Snyder, N. F. R. and J. W. Wiley. 1976. Sexual Dimorphism in Hawks and Owls of North America. Orn. Mono. 20. Publ. A.O.U., 96pp.

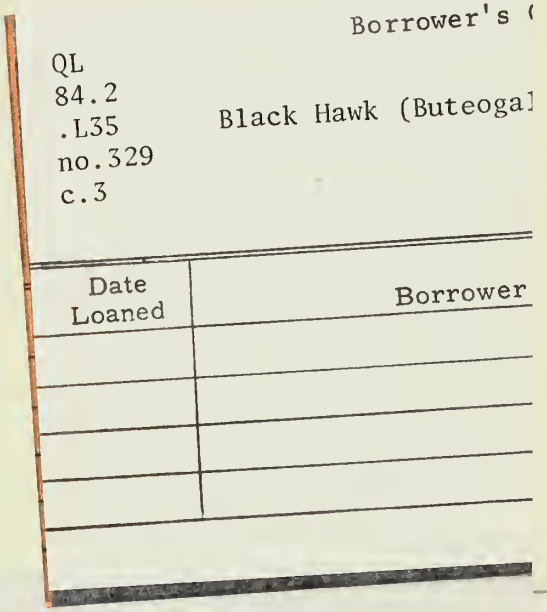
Stager, K. E. 1954. Birds of Chihuahua, Mexico. Condor 56:21-32.

Thomas, G. B. 1908. The Mexican Black Hawk. Condor 10:116-118.

Wauer, R. H. and R. C. Russell. 1967. New additional records of birds in the Virgin River Valley. Condor 69:420-422.

Webster, F. R. Jr. 1976. The Nesting Season-June 1 to July 31, 1976. Amer. Birds 30:975-978.

☆U.S. GOVERNMENT PRINTING OFFICE: 1980—677-659/286



Borrower's (

Black Hawk (Buteoga

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